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SOUTH AFRICAN SPECIES OF CYNODON (GRAMINEAE)[1]

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ABSTRACT

The genus *Cynodon* Rich. is represented in South Africa by *C. aethiopicus* Clayton et Harlan ($2n=18$), *C. dactylon* (L.) Pers. var. *dactylon* ($2n=36$), var. *aridus* Harlan et de Wet ($2=18$), var. *elegans* Rendle ($2n=36$) and var. *polevansii* (Stent) Harlan et de Wet ($2n=36$), *C. incompletus* Nees var. *incompletus* ($2n=18$) and var. *hirsutus* (Stent) de Wet et Harlan ($2n=18$), and *C. transvaalensis* Burtt-Davy ($2n=18$). Several sterile, triploid hybrids between *C. dactylon* var. *dactylon* and the diploid ($2n=18$) taxa were collected. One such hybrid is widely cultivated and known taxonomically as *C. magennisii* Hurcombe. The cultivated *C. bradleyi* Stent was shown to represent a hybrid between the two varieties of *C. incompletus*.

UITTREKSEL

SUID-AFRIKAANSE SOORTE VAN CYNODON (GRAMINEAE). Die geslag *Cynodon* Rich. word in Suid-Afrika verteenwoordig deur *C. aethiopicus* Clayton en Harlan ($2n=18$), *C. dactylon* (L.) Pers. var. *dactylon* ($2n=36$), var. *aridus* Harlan en de Wet ($2n=18$), var. *elegans* Rendle ($2n=36$) and var. *polevansii* (Stent) Harlan en de Wet ($2n=36$), *C. incompletus* Nees var. *incompletus* ($2n=18$) and var. *hirsutus* (Stent) de Wet en Harlan ($2n=18$) and *C. transvaalensis* Burtt-Davy ($2n=18$). Verskeie onvrugbare, triploiede kruisings tussen *C. dactylon* var. *dactylon* en die diploiede ($2n=18$) taksa was versamel. Een so 'n kruising word op groot skaal gekweek en is taksonomies as *C. magennisii* Hurcombe bekend. Die gekweekte *C. bradleyi* Stent word getoon 'n kruising tussen die twee varietete van *C. incompletus* te wees.

INTRODUCTION

The genus *Cynodon* Rich. is a small genus, confined primarily to the tropics and subtropics of the Old World, but with one species, the weedy *C. dactylon* (L.) Pers., extending almost continuously across all continents and islands between about 45° N and 45° S latitude. The genus is particularly variable in southern Africa where several taxa of uncertain taxonomic status were described (Stent, 1927). The relationships among these traditionally recognized species and varieties were studied.

MATERIAL AND METHODS

Several hundred collections of *Cynodon* were studied in their natural habitats in southern Africa, and some 250 of these were grown from seeds or cuttings

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and transplanted to a uniform nursery at the Oklahoma Experiment Station, Stillwater. Herbarium specimens of these collections are filed with the Crop Evolution Laboratory, Department of Agronomy, University of Illinois. Hybrids were produced by W. L. Richardson using a modification of a technique described by Richardson (1958). Chromosome number and cytological behavior were determined from developing microspore mother cells stained with acetocarmine. The morphological data were supplemented by studies of the *Cynodon* collections filed at Kew, England, and the Botanical Research Institute at Pretoria, South Africa.

RESULTS

The South African respresentatives of *Cynodon* are usually subdivided among three non-rhizomatous taxa, *C. bradleyi* Stent, *C. hirsutus* Stent and *C. imcompletus* Nees, and four rhizomatous taxa, *C. dactylon*, *C. magennisii* Hurcombe, *C. plovansii* Stent and *C. transvaalensis* Burtt-Davy.

The non-rhizomatous taxa are closely allied to each other. *Cynodon bradleyi* is widely cultivated, and seem to have originated from a single population found growing wild in unbroken veld at Orange Grove, Johannesburg. Stent (1927) suggested that this species represents a hybrid between *C. hirsutus* and *C. dactylon*. Such an origin is unlikely, as the assumed parental species are diploid ($2n=18$) and tetraploid ($2n=36$) respectively, while *C. bradleyi* is a diploid. It resembles *C. hirsutus* in leaf pubescence and gross inflorescence structure, but the glumes are smaller. Typically, *C. hirsutus* has lower glumes that are about half as long as the spikelets, and upper glumes that are at least 3/4 the spikelet length, while the lower glume of *C. bradleyi* is about 1/3 and the upper glume about 1/2 as long as the spikelet. Stent (1927) described *C. hirsutus* var. *parviglumis* to include plants which have shorter glumes than the type. Several such populations were collected in the arid western Transvaal around Delareyville, and at Bloemfontein in the Orange Free State. Except that they are slightly less hairy, and have slightly longer leaves, these collections resemble *C. bradleyi* very closely. They also match in detail artificially produced hybrids between *C. hirsutus* and *C. incompletus*. These hybrids are fully fertile, and *C. bradleyi* crosses readily with *C. hirsutus* var. *parviglumis* to produce fertile hybrids.

Cynodon hirsutus and *C. incompletus* are closely allied morphologically, differing from each other primarily in degree of pubescence and glume size. Typical representatives of *C. incompletus* have leaves that are at most moderately pilose, lower glumes that are about 1/4 as long as the spikelet, and upper glumes that are slightly less than 1/2 the spikelet length. Hirsute leaves, and glumes that are 1/2 to 3/4 as long as the spikelet characterize *C. hirsutus*. These two taxa maintain their unity of type primarily because of ecological, and also to some degree geographic isolation. *Cynodon incompletus* is widely distributed in the more arid regions across the Karroo, Orange Free State and West Transvaal, while *C. hursutus* is widely distributed in the Bushveld but also extends into the Highveld and the Karroo. Their distribution ranges overlap extensively in the western Transvaal, and natural hybrids are common where they grow together. Morphological and cytogenetical data indicate that the three non-rhizomatous South African taxa *C. bradleyi*, *C. hirsutus* and *C. incompletus* belong to a single species (Harlan et al., 1970).

The rhizomatous collections include both diploids and tetraploids. *Cynodon transvaalensis* is strictly diploid ($2n=18$). This species is widely cultivated as a lawn grass, with widely scattered, possibly natural populations in damp habitats across the southern and western Transvaal. These may represent relics of a once common wild species. It is very uniform morphologically. Leaves are narrowly linear and yellowish green, two characters that distinguish *C. transvaalensis* from all other *Cynodon* species. Inflorescences of *C. transvaalensis* are small, with rather loosely arranged spikelets, and somewhat resemble those of small, cultivated races of *C. dactylon*. Stent (1927) assumed that *C. transvaalensis* originated as a hybrid between *C. dactylon* and *C. hirsutus*. Attempts to cross *C. transvaalensis* with representatives of the non-rhizomatous complex failed, but it crossed readily with tetraploid and diploid *C. dactylon* to produce sterile hybrids. The cultivated triploid *C. magennisii* resembles some of the artificially produced hybrids in morphological detail, and probably originated from such a cross (Hurcombe, 1947).

Cynodon polevansii is narrowly endemic to arid habitats in the western Transvaal that are seasonally flooded. In its natural habitat *C. polevansii* is a compact plant with short, stiffly erect leaves, well developed rhizomes, and slender flowering culms bearing inflorescences of 2—4, often reflexed racemes. Because of its compact growth habit, and narrow leaves, Stent (1927) suggested close affinities with *C. transvaalensis*. When plants from the type locality were planted in our uniform nurseries, however, they resembled *C. dactylon* rather than *C. transvaalensis* more closely. From *C. dactylon* these plants differed primarily in having narrow, erect leaves, and from *C. transvaalensis* they differed very obviously in their more robust growth habit. All collections of *C. polevansii* are tetraploid, and this taxon crossed readily with collections of *C. dactylon* to produce fertile hybrids. Several obviously hybrid populations were collected from the type locality. For these reasons *C. polevansii* was transferred to *C. dactylon* as a variety by Harlan and de Wet (1969).

Cynodon dactylon is an extremely variable species, widely distributed across the world between about 45° N and 45° S latitude. The South African materials are of three very distinct morphological types. The widely cultivated lawn grass, which is also widely distributed as an urban and roadside weed, is a compact plant with $2n=36$ chromosomes. Collections range in size from small races that are used as lawn grasses to robust weeds that produce flowering culms up to 20 cm tall. The common, native *C. dactylon* south of 12° S latitude, however, is a lax plant with slender rhizomes and inflorescence branches. These collections correspond exactly with the type of *C. dactylon* var. *elegans* Rendle, from Mossamedes in Angola (B). It is a tetraploid and extends from the coastal plains to the Highveld, across most of the veld types described by Acocks (1953). Diploids that resemble variety *elegans* in growth habit were collected at Middelburg in the Cape Province. Morphologically similar plants were also collected in Tanzania, Israel and India, and *C. dactylon* var. *aridus* was described by Harlan and de Wet (1969) to include these diploids.

Hybrids between *C. dactylon* var. *dactylon* and var. *elegans* are easy to produce and are fertile. Natural hybridization is not common, probably because these two varieties occupy different habitats, var. *dactylon* being a weed (Harlan and de Wet, 1965) while var. *elegans* forms part of the natural grass vegetation. The diploid, *C. dactylon* var. *aridus* crosses readily with the tetraploids to form sterile triploid hybrids. It was also crossed with *C. hirsutus*, *C. imcompletus* and *C. transvaalensis*. These hybrids are sterile with 0—6 univalents present during meiotic metaphase of microsporogenesis (Harlan et al., 1970).

Several collections from around Barberton and Tzaneen in the eastern Transvaal, resemble a robust *C. dactylon*, but are non-rhizomatous. These collections are diploid and belong with *C. aethiopicus* a species widely distributed along the rift valleys from South Africa to Ethiopia (Harlan, de Wet and Richardson, 1969; Clayton and Harlan, 1970). This species may be more common along the mountains in South Africa than would appear from the few specimens available in herbaria.

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